

Since this, whilst carrying on in my garden that seemingly unavoidable slaughter of slugs, I have on two occasions extracted the *Mermis* from the bodies of the common white slug (*Limax agrestis*). The last instance was in May 1865, when, while killing a small slug about three-quarters of an inch long, with a piece of stick, I saw that I had another worm, and extracted it entire, without injury; it was more than three inches in length, cream-coloured, with a faint dark line, firm and rigid as usual: it surprised me that it could have been carried about in so small a compass. This individual I kept alive some time in a small phial, with a drop of water to keep it moist.

It is easy to speculate on the object the hair-worm has to attain in climbing during or immediately after a shower; possibly it may be the deposition of ova.

Hurstpierpoint, Nov. 1867.

Experiments on the Axolotl. By M. AUGUSTE DUMÉRIL.

Since I had the honour of informing the Academy that the Mexican Urodelous Batrachia with external branchiæ, called axolotls, which had never previously been seen living in Europe, had reproduced in the Menagerie of Reptiles, and that many of those born there had undergone metamorphoses*, numerous births have taken place there, and other transformations like the former have occurred. Thus, up to the present time, we have seen sixteen of these animals become covered with yellowish-white spots contrasting with the darker general tint, then lose their branchial apparatus completely, as well as the membranous crest of the back and tail. At the same time the internal organs have undergone changes comparable with those which are observed in the Urodelous Batrachia in passing from the larval to the adult state. Of the four arches supporting the branchiæ which float outside, three have disappeared; the outermost one alone remains, and constitutes the posterior joint of the thyroidean horn. The anterior surface of the bodies of the vertebræ has become less concave. As in all the other Salamandriform Batrachia, a modification has taken place in the arrangement of the dental apparatus of the vault of the palate, the vomerine teeth having changed their place. They were united on each side behind the intermaxillary bone into a small band slightly oblique from in front and within, backwards and outwards; but after the metamorphosis they form, beyond the inner orifices of the nasal fossæ, a nearly transverse row—an arrangement which, with the absence of the posterior palatine teeth, occurs only in the North American tritons called *Amblystomi*, of which the axolotls consequently appear to be the tadpoles. In the lower jaw, to the right and left of the symphysis behind the marginal row, there was a group of small teeth which is no longer to be seen.

Such is a very summary general account of the characteristic facts of a metamorphosis never previously observed, and which possesses

* Comptes Rendus, tome lx. p. 765, and lxi. p. 775: see Annals, ser. 3. vol. xvii. p. 156.

a peculiar interest inasmuch as it confirms the justice of Cuvier's supposition when he said, without having been able to obtain any direct proof of it, that the axolotl, although regarded as a Perenni-branchiate Batrachian, would prove to be a larva.

I have not time to enter upon an examination of the different questions which arise from these unexpected observations, which have been made for nearly two years at the menagerie, the most important of which, in a physiological point of view, is, undoubtedly, that which demonstrates the development of the generative power in animals which have not yet arrived at their definitive form. These observations have been published in the 'Nouvelles Archives du Muséum' (tome ii. pp. 265-292, pl. 10).

I now take the liberty of submitting a summary account of some experiments to which I was led by the study of the facts just indicated. The atrophy of the branchial tufts and their gradual disappearance being the first signs of the metamorphosis which is going to take place, I have endeavoured to provoke a change in the mode of respiration by obliging the animals to make use of their pulmonary organs. I made at first some fruitless experiments, consisting partly in gradually diminishing the quantity of water in which the axolotls were kept, so as to leave them, after a certain time, nothing but a layer of damp sand, and partly in arranging in their aquarium a broad shelter, which enabled them to live alternately immersed and out of the liquid.

To obtain any result there was another experiment to be made. It was necessary to destroy the branchiæ, in order to ascertain whether, when rendered compulsorily animals with a pulmonary respiration, the axolotls would undergo the modifications which I have enumerated.

Accordingly, on the 4th of July 1866, I completely removed the three branchial stalks on the left side in two axolotls, and those of the right side in a third; then, from the 14th to the 28th, I cut off every week one of the branchial stalks of the opposite side. At this last date the axolotls would have been entirely deprived of the branchiæ if, during the twenty-four days which had elapsed since the first operation, the astonishing power of regeneration with which the Urodela Batrachia are endowed had not caused the commencement of a reproduction of the organs which had been removed. Therefore, in order to keep the axolotls in the state in which I wished to place them, so that I might appreciate the results of the experiment, I cut away successively, on either side, the new branchial stalks as soon as they began to project sufficiently to be removed by the scissors. From the 28th of July 1866 to the 24th of May 1867 (that is to say, a period of ten months), I was obliged to operate, either on the right or left side, three, four, or even five times. During the winter the reproduction was much slower.

On the 10th of August 1866, I cut off the three branchial stalks of the right side of six axolotls, and, wishing to exert a more general and rapid action, on the 17th also the three branchiæ of the left side. As in the other cases, there was scarcely any hæmorrhage,

nor did any ill event supervene ; the cicatrization was rapid, and the power of reproduction soon manifested itself. The following amputations were made at once on the six animals—on the right on the 21st, and on the left on the 28th of September.

The branchiæ, after the second removal, were scarcely developed ; and several of the animals operated upon began to acquire a new aspect in consequence of the appearance of some yellow spots on the skin. Two of these individuals became more and more spotted, lost their crest, and finally became like the axolotls which had previously been transformed. The four other axolotls of the same series, but especially two of them, presented some spots, without any trace of metamorphosis ; their branchiæ having acquired a slight development, I amputated those of the left side on the 8th of March, and those of the right side on the 5th of April.

One of these axolotls continued spotted, but without any other marked change ; there was scarcely any regeneration of its branchiæ. In the three others it was rather more evident ; and on the 24th of May I cut off the branchiæ on each side, and again on the 22nd of June, little buds having been developed.

Thus of six axolotls deprived of their branchiæ, and in which care was taken to oppose the regeneration of the lost parts, two became completely metamorphosed in from four to five months ; and a third at the end of nearly a year seems to have undergone the same changes ; whilst the other three, after the same lapse of time, are in a state which leaves the observer still uncertain as to the definitive result of the experiment. It even seems probable that, like the three axolotls of the first series, they will not be transformed, and that, consequently, three only, out of nine deprived of their branchiæ, have passed from the larval to the perfect state.

Such a proportion is much greater than that observed among the individuals which have undergone no amputation. I indicate the facts, without, however, wishing to draw the conclusion that the loss of the branchial tufts is a condition very favourable to the accomplishment of the metamorphosis. Moreover most of the transformations were not preceded by functional disturbances resulting from the mutilations.

Reverting now to the immediate results of the removal of the branchiæ, I may add that their resection, which would seem to imply the production of formidable effects, and even to compromise existence, may be practised without inconvenience in a more expeditious manner. On the 7th of June 1867, I removed the whole of the branchial tufts from both sides at once of eight axolotls. Nothing particular was afterwards observed ; and on the 22nd of June and 6th of July I effected the removal of all the buds of new formation, which are already beginning to be reproduced.

These mutilations appear to me to have some interest. Here we have, in fact, animals which, when deprived in a short space of time, or even suddenly, of their organs of aquatic respiration, do not experience, at least as far as six out of nine of them are concerned, any disturbance, and continue to live as if the branchiæ had not been removed. Coming no oftener than axolotls which had not been

operated upon to take air at the surface of the water, they neither presented in their movements nor in their mode of life any apparent modification, the cutaneous respiration replacing the branchial.—*Comptes Rendus*, August 5, 1867, pp. 242–246.

Note on my former Communication on a supposed New Species of Planarian Worm.

To the Editors of the Annals and Magazine of Natural History.

GENTLEMEN,—In the October Number of the 'Annals' I drew your attention to what I believed to be an undescribed species of a Rhabdocœl Planarian worm, which I proposed to call *Typhloplana nigra*. Living as I do in the country, I am in a great measure dependent on my own library for books of reference. Since writing to you, I have procured a copy of Oscar Schmidt's work 'Die Rhabdocœlen Strudelwürmer,' and on Taf. 4. fig. 10 I find an excellent figure of my Planaria, which appears to be not a *Typhloplana*, but a *Mesostomum*, and the *M. personatum* discovered by Schmidt. From what Dr. Schmidt says, it appears that the adult animal is possessed of eyes, which, however, are concealed in the black pigment; young individuals just emerging from the egg have two distinct eye-specks. The chief difference between the genera *Mesostomum* and *Typhloplana* is the absence of eyes in the latter. Hence, as I could discover none in the specimens I examined, I referred the creature to the genus *Typhloplana*. It is, however, clearly identical with the *Mesostomum personatum* of Schmidt, and I cancel my former conjecture, and add this species of Rhabdocœl planaria to the British fauna. *Hab.* Reedy pond near Preston.

I remain, Gentlemen,
Yours sincerely,

Preston Rectory, Wellington, Salop.
Nov. 15, 1867.

W. HOUGHTON.

On the Development of Sepiola. By E. MECZNIKOW.
(Notice by E. Claparède.)

As M. Mecznikow's memoir is published in Russian, we give a rather detailed notice of it.

Besides the old writings of Bohadsch and Delle Chiaje, we possess on the development of the Cephalopoda an unsatisfactory memoir by M. Van Beneden, and a more important work by M. Kölliker. The latter, although more complete, still leaves some gaps to be filled up.

The ova of the *Sepiolæ*, investigated at Naples by the author, resemble the eggs of the common fowl in their form, although not in their size (they are only 4 millims. in length); they are contained to the number of fifteen together in a colourless mucilage. Each ovum is furnished only with a single envelope; this chorion does not appear to correspond with the outer membrane of the ova with double envelopes of other Cephalopoda (*Sepiæ*, Squids), but rather to their inner envelope, which M. Kölliker and others have regarded as the vitelline membrane. This latter denomination seems